UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

DATE: JUN 9 1982

SUBJECT: Nonintrusive Investigations Syntex Trenches

FROM: Kenneth S. Ritchey, Regional Dioxin Coordinator
Waste Management Branch, Region VII

TO: See Below

Attached for your review and comment is the nonintrusive investigation of the five Syntex trenches located on Syntex Agribusiness', Inc., Verona plant. I would appreciate verbal or written comments by June 20, 1982. If you have questions, please contact me at x6533 or FTS: 758-6533.

Attachment

cc: Dennis Devlin, WH-527
Dan Harris, ENSV
Dan Shiel, CNSL
Katie Biggs, WMBR

Site: Syntex Verona
ID # MOD007452154
Break: 1.6
Other:
6-9-82

0751

Don Harris

NON-INTRUSIVE SUBSURFACE EVALUATION

SYNTEX FACILITY

VERONA, MISSOURI

91/7-02 46

NON-INTRUSIVE SUBSURFACE EVALUATION

SYNTEX FACILITY

VERONA, MISSOURI

Terracon

CONSULTANTS, INC.

GEOTECHNICAL AND MATERIALS ENGINEERS

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Richard M. Scott

May 27, 1982

Syntex Agribusiness, Inc.
P. O. Box 1246 SSS
Springfield, Missouri 65805

ATTN: Mr. Ray Forrester

RE: Non-Intrusive Investigation,
Syntex Facility, Verona,
Missouri
Job No. 281613

Gentlemen:

We are submitting, herewith, the results of the non-intrusive subsurface exploration and engineering evaluation for the above referenced project. The purpose of this exploration was to identify specific locations of trenches containing buried waste products. Based on the information obtained, a program for an intrusive investigation for sampling of the waste product would be made.

We appreciate the opportunity to work with you on this phase of the site exploration and are prepared to provide the required services relating to the intrusive investigation. If you have any questions regarding this report, please contact us.

Respectfully submitted,

TERRACON CONSULTANTS, INC.

Glen Ferguson

Glen Ferguson, Ph.D.
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NON-INTRUSIVE SUBSURFACE EVALUATION
SYNTEX FACILITY
VERONA, MISSOURI

May 27, 1982
Job No. 281613

INTRODUCTION

The non-intrusive subsurface evaluation for the above project has been completed. Procedures utilized consisted of a resistivity survey and utilization of a metal detector. Discussion of the specific test procedures utilized and a summary of the information obtained are presented in the following sections of this report.

The waste disposal site is located along the center of a ridge located northwest of the existing Syntex facility in Verona, Missouri. The existing plant facility is located in the Spring river flood plain, near the south valley wall. The waste disposal site is located across the river and on the north valley wall. At this location the Spring river runs from southwest to northeast. The ridge on which the disposal site is located is oriented on a north/south line and terminates approximately 400 feet south of the site.

It is our understanding that five trenches ranging in length from 60 feet to in excess of 400 feet were excavated in the site. The trenches were excavated by a dozer and had widths of approximately 8.0 feet. Based on available information, depths of trenches range from 6.0 to 10. feet. For purposes of identification, the trenches have been numbered 1 through 5 with Trench 1 being located at the west edge of the site and Trench 5 being located at the east edge of the disposal site and near approximate center line of the ridge. It is our understanding, based on available plant operation records and records of grading contractors who excavated the trenches, that waste material, possibly containing dioxin, is contained only in Trenches 4 and 5.

A fence surrounding Trenches 4 and 5 was erected prior to the non-intrusive survey. The fence was used as a means of referencing all site work. The fence located to the east and parallel to the trenches was assumed to be on a north/south line and is designated as site north. All survey lines were established parallel to this line. Distances along the respective survey lines were referenced to the fence located to the south of the trenches.

The purpose of this report is to present data obtained during the non-intrusive site survey, to analyze and evaluate the test data and to make recommendations regarding establishing a scope of work for the intrusive phase of the investigation.

NON-INTRUSIVE EXPLORATION PROCEDURES

Non-intrusive test procedures consisted of the use of a profiling resistivity survey and the utilization of a metal detector equipped with coils providing sensitivies to depths of 6.0 to 10.0 feet. In addition, a careful observation of the site was made. Consolidation of material incorporated in the trenches has occurred and has resulted in subsidence of the surface at several locations over the trenchs. Locations where distinct subsidence was noted were established and these locations are shown in the attached site plan.

Resistivity Survey

The resistivity survey conducted consisted of a profiling survey utilizing a fixed electrode spacing. A Soil Test Strata-Scout Model R40C resistivity meter was utilized. All resistivity tests were conducted utilizing a Wenner Electrode configuration using a fixed electrode spacing of 8.0 feet. The Wenner configuration consists of four electrodes, equally spaced on the survey line. The inner two electrodes serve as potential electrodes. Upon application of a controlled, alternating current to the two outer electrodes, a theoretical equal potential line of electrical activity is induced around each electrode. The effective depth of investigation of the resistivity survey is the function of electrode spacing and for the Wenner configuration, the depth of investigation is approximately equal to the spacing between individual electrodes. The purpose of the investigation was to identify lateral extent of the trenches and areas where concentration of the waste products exist. To provide this information, the electrode spacing was set at 8.0 feet to better define variations within this depth and to minimize influence of variations in soil and ground water conditions below the trench area.

A total of 14 grid lines were established in the disposal site with the lines being oriented approximately parallel to the trenches. Grid lines were established in the field by offsets from the fence line located immediately east of Trench 5. Referencing of grid lines in this manner was intended to better allow integration of the non-intrusive investigation with the site survey currently in progress. Grid lines were spaced at 8.0 foot intervals from east to west across the trench locations. To provide better definition, additional survey lines on 4.0 foot spacings were established in the vicinity of Trenches 4 and 5. On each of the survey lines, resistivity readings were obtained on 8.0 foot intervals with the electrodes being oriented on the respective lines. The apparent resistivity obtained was assumed to be at the mid-point of the electrode array.

During the initial phase of the resistivity survey, surficial soils were relatively dry and adequate electrode contact could not be established. To develop electrical continuity, it was necessary to pour water adjacent to each electrode. A calibration area was established southeast of the trench locations and at a sufficient distance to be beyond the influence of materials within the trench. Resistivity measurements were taken at this location daily to evaluate possible influences of variations in soil moisture and other possible variations. The resistivity survey was suspended at several times due to rain and while moisture contents in the surficial soils increased to a point that electrical conductivity could be established without the addition of water adjacent to the electrodes, it appears that this was a surface effect as only a minor variation in resistivity was determined at the standardization point.

Several of the survey lines were located in close proximity and parallel to the existing fence surrounding Trenches 4 and 5. Apparent resistivity determined adjacent to the fence and at locations beyond the influence of the trench were of the same order of magnitude as resistivity measurements made at the calibration point and at other locations well outside the influence of trenches and away from the fences. It is probable that the low moisture content of surficial soils tended to reduce the influence of the fence by significantly increasing the resistance between the soil and the steel posts. Also, a majority of the survey lines in the immediate vicinity of the fence were completed prior to the period of precipitation and while moisture content of surficial soils were quite low.

Metal Detector

The metal detector utilized was a Garret EDSI detector with two 12 by 16 inch coils to provide greater depth of resolution. The detector equipped with these coils is capable of detecting large metallic masses at depths of up to 10.0 feet. To provide a means of calibration, six barrels were buried at controlled depths outside the trench areas. Top of barrels were at depths of 4.0, 6.0 and 8.0 feet. At each depth, one barrel was oriented with it's axis in a vertical plain and the other barrel was located with the axis horizontal. The excavations were backfilled to original grade. Barrels buried at depths of 4.0 feet were located by the detector, however, barrels located at depths of 6.0 and 8.0 feet could not be detected. Response of the detector to buried metallic objects is significantly influenced by length of time of burial. Iron oxide associated with rusting of buried ferrous materials diffuses into the adjacent soil and significantly increases the response of the detector. A very pronounced response to the detector was obtained in the trench areas. This greater level of response as compared to the test location may be attributed to a higher concentration of metal or that more extensive oxidation of these materials has occurred. Where response of the detector occurred, the response was of such a magnitude that only lateral extent of the buried metallic objects could be defined and location of individual barrels or objects was not possible. The lateral limits of areas indicating the presence of buried metallic material were flagged and subsequently referenced to the east and south fence lines.

ANALYSIS AND CONCLUSIONS

Metal Detector and Site Observations

The metal detector was utilized throughout the trench areas to identify areas having buried metallic materials. At a majority of the locations, a very prounounced response was obtained. Location of response points are presented on Figure 1. The symbols utilized denote the direction from the point where a distinct response to metallic objects was obtained. In general, the response obtained was of such a magnitude within the respective areas that identification of individual barrels or objects was not possible.

Visual Site Survey

As previously discussed, subsidence of material within the trenches was evident at several locations. The observed subsidence ranged from approximately 6 to 18 inches. Areas exhibiting distinct subsidence were identified in the field. Location of these lines were referenced to the east and south fence line and are presented on Figure 1. The dashed line represents lines along which subsidence is readily apparent. At a majority of the locations, the observed subsidence closely approximates areas where metallic objects were identified by the metal detector. At several locations, variations exist and may be related to the presence of non-metallic materials in the trench.

Site Resistivity Survey

Approximately 500 measurements of resistivity were obtained throughout the site. Measurements were taken on 8.0 foot centers along each of the survey lines with initial measurements being taken approximately 14.0 feet from the south fence line. Survey lines were located on 8.0 foot centers except in the vicinity of Trenches 4 and 5 where a 4.0 foot spacing was utilized. Resistivity determinations were made along each survey line to the north well beyond the trench area.

The resistivity device is read directly in Ohms and may be converted to apparent resistivity. For the Wenner configuration of electrodes, apparent resistivity for any electrode spacing may be obtained by the following relationship.

$$\rho = 2\pi a \frac{V}{I}$$

If a is in feet instead of meters, $\rho = 191\ a \frac{V}{I}$

where V is in volts, I is in amps and ρ is in Ohm-centimeters. By Ohms law, resistance $R = \frac{V}{I}$

where V is the induced voltage and I is the resultant current flow. Since a uniform electrode spacing of 8.0 feet was utilized for all resistivity determinations, resistivity for a specific measurement could be obtained by the following relationship.

$$\rho = 1530R$$

where R is the measured resistance utilizing the Wenner configuration.

A profile survey was utilized to evaluate variation in resistivity across the site. Presence of metallic drums, water, and other compounds within the trenches would influence the resistivity within a given area. Variations in observed resistivity would therefore be indicative of a concentration of material within the trenches and would aid in defining location of trenches and concentration of buried compounds. All readings obtained were plotted at the respective test location and contours of equal resistance were developed. These contours are presented in Figure 2. Actual values of resistivity for each of the plotted contours are presented on the attached table. In general, measured resistances well outside the influence of the trenches range, from 150 to 400 Ohms (resistivity = 230×10^3 to 611×10^3 Ohm-centimeter). Measured resistances within the immediate trench area were generally less than 60 Ohms (92×10^3 Ohms-centimeter) with the lowest observed resistivity being approximately 6 Ohms (9×10^3 Ohms-centimeter).

As may be noted on the contours of equal resistance, locations indicating resistance of less than 20 Ohms (30×10^3 Ohm-centimeters) are generally indicative of areas containing greater quantities of buried waste materials and in general are located within trench areas defined by the metal detector and site observation. To better define the zones of lower resistance, contours of equal resistance for both 20 and 40 Ohms are presented on Figure 3.

SUMMARY

A considerable amount of buried material appears to be present in Trench 5 between distances of 25 and 85 feet from the south fence line. Based on conditions detected by the metal detector and site observation, it appears that Trench 5 extends over a distance of approximately 8.0 feet to 120.0 feet from the south fence line which covers a greater distance that indicated by the resistivity survey. It is probable that excavation of the trench required access ramps at either end and that maximum trench depth existed only within the central portion of the trench. During filling of the trench, barrel rings and other metallic objects could have been buried on the access ramp which would account for response of the metal detector in these locations while the main concentration of metallic objects and other materials influencing resistivity would be within the central portion of the trench. Also, ground water collecting in the trench could be concentrated primarily in the central portion.

In the central portion of Trench 5, the area of low resistance extends west of the trench limits defined by surface subsidence and the metal detector. Trench 5 is in close proximity to Trench 4 in this area and sloughing of the excavation may have occurred.

Within Trench 4, only limited areas having low resistivities were observed at the southern end of the trench with these areas being located primarily between distances of 24.0 and 82.0 feet from the south fence line. Between distances of 82.0 feet and 140.0 feet significantly higher resistances were obtained and would tend to indicate a discontinuity in the material present within the trench. Also, depth of trench at this location may be significantly less. Within Trench 4 at distances of 140 to 320 feet from the south fence line a significant area exhibiting low resistivity was encountered. Within this area, surface observations for Trench 4 indicate a slight change in direction to the east. Trench 3 located immediately east of the fence line also diverges to the east in this area. It appears that excavation for Trench 4 may have extended into the excavation for Trench 3 and overlapping of the trenches may account for the more extensive zone of low resistivity. An additional factor may contribute to the extensive zone of low resistivity in the vicinity of Trenches 4 and 3. As previously discussed, the disposal site is located along a ridge, however, ground elevations in the south half of the site generally slope to the north and ground surface in the north half of the site slopes to the south. The low point exists approximately 160 to 200 feet north of the south fence line within the area of low resistivity observed in Trench 4. Surface topography may therefore, increase infiltration of surface water in this area which could influence the observed resistivity. Comparison of the area of low resistivity to the site survey could aid in evaluating this condition.

Resistivities observed in the south half of Trench 3 were significantly higher than observed in Trenches 4 and 5. While the metal detector indicated the presence of buried metallic materials, the relative extent and response was less than observed in other trench locations. The higher resistivity readings observed in this area may be a result of less waste product being present or trenches being of a shallower depth. As previously discussed, Trench 4 appears to impinge on Trench 3 at a distance of 200 feet from the south fence line and significantly lower resistivities were observed in this area.

Based on site observations and response of the metal detector, Trench 2 appears to be located within an area of from 120 to 300 feet from the south fence line. Resistivities observed in this area were generally higher and would tend to indicate relatively shallow trench depth or that lower concentrations of waste products exist within this trench line.

Based on site observations, Trench 1 begins approximately 200.0 feet north of the fence line and continues approximately 200.0 feet. This trench is located immediately adjacent to the top of slope and it appears that excess soil associated with the trench excavation has been pushed over the edge of the slope. As indicated on Figure 3, low resistivity readings were obtained in Trench 1 at distances of 240 to 400 feet from the south fence line. Zones of low resistivity appear to extend west of the trench line as defined by site observation and the metal detector. This deviation may be indicative of lateral movement of materials in the trench at this location.

It appears that the scope of work for the intrusive phase of the exploration can be established based on the resistivity information presented in Figure 3. Major areas of concern would be the central portion of of Trench 5 and localized areas in the south end of Trench 4. The north end of Trenches 4 and 3 should also be evaluated to define the type and extent of materials within this area. Installation of monitoring wells along the west edge of the disposal site at a distance of 200 to 250 feet from the south fence line should also be considered. Lower resistances observed in this area may indicate lateral migration of ground water in this area. Resistivities observed to the east of the trenches were all quite high indicating a low potential for ground water migration through this area at the depths evaluated.

GENERAL

The analysis and conclusions presented in this report are based upon the data obtained from the nonintrusive survey and from any other information discussed in this report. This report does not reflect any variations which may occur across the site and such variations may not become evident until information developed by the intrusive investigation can be evaluated.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted engineering practices. No other warranty, expressed or implied, is made.

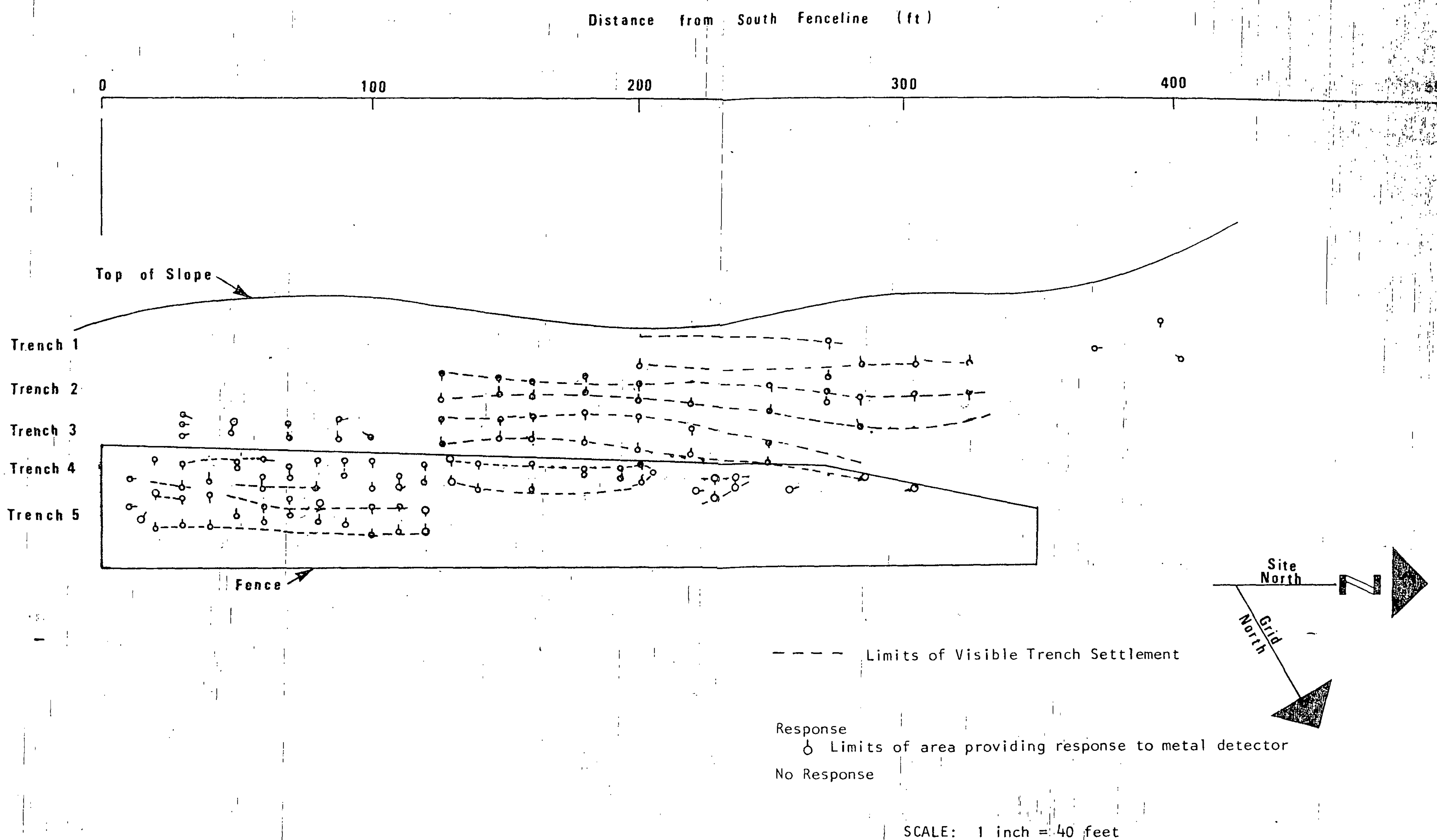


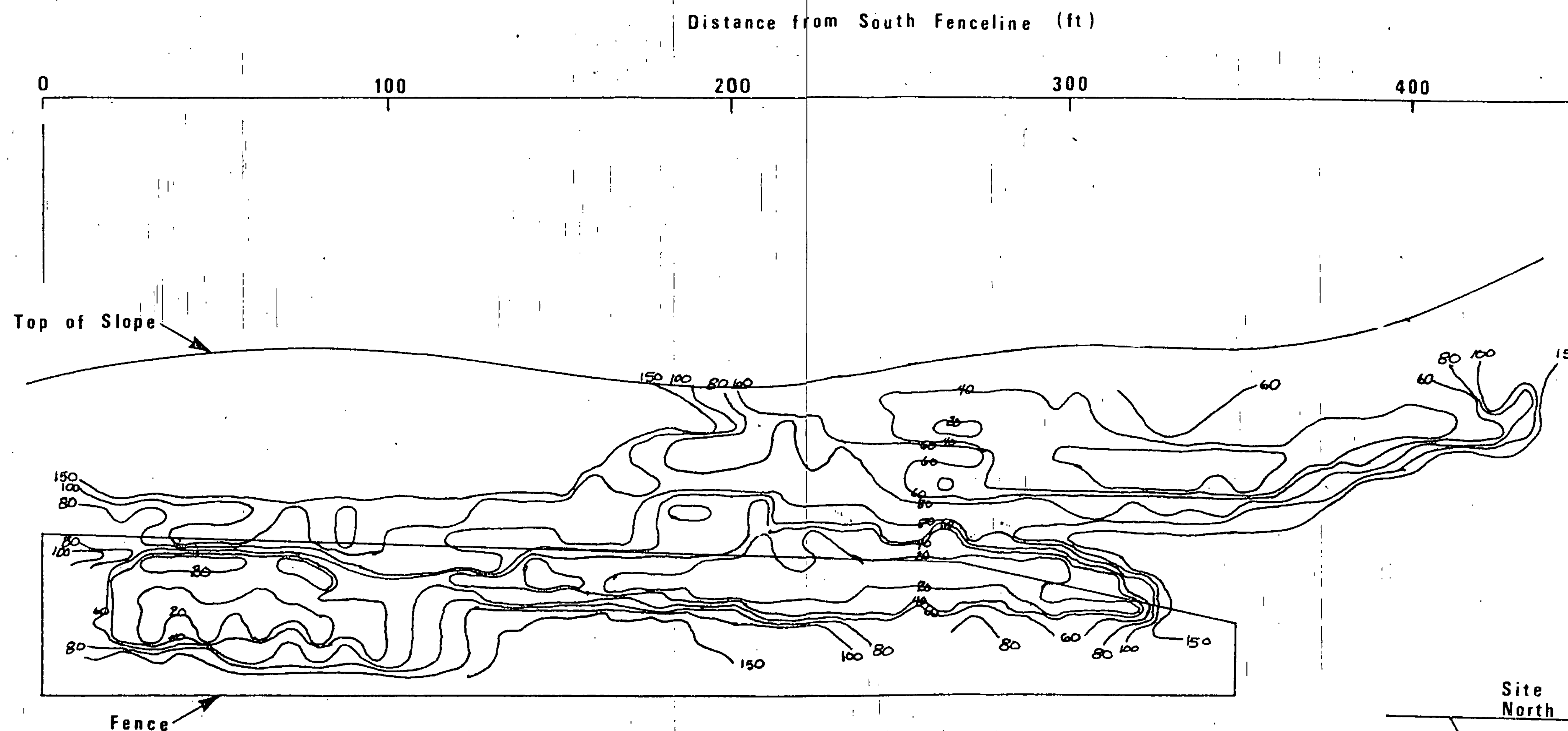
FIGURE 1

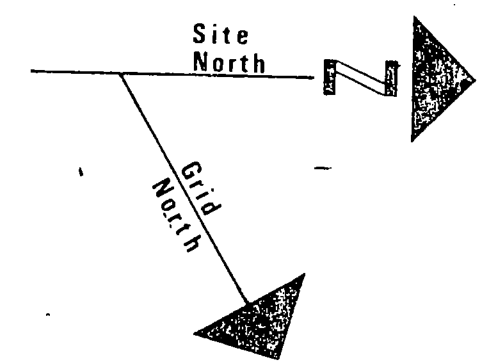
Visual Survey and Metal Detector Survey

Terracon Consultants, Inc.

Cedar Falls Cedar Rapids Davenport
Des Moines, IA
Kansas City Wichita, KS

1"=40'	GF	5-26-82	281613





Measured Resistance (Ohms)		Apparent Resistivity (Ohm - cm)
20	----	$31(10)^3$
40	----	$61(10)^3$
60	----	$92(10)^3$
80	----	$122(10)^3$
100	----	$153(10)^3$
150	----	$229(10)^3$

SCALE: 1 inch = 40 feet

FIGURE 2

RESISTIVITY SURVEY

Terracon Consultants, Inc.
Cedar Falls Cedar Rapids Davenport
Des Moines, IA
Kansas City Wichita, KS

1''=40'	GF	5-26-82	281613

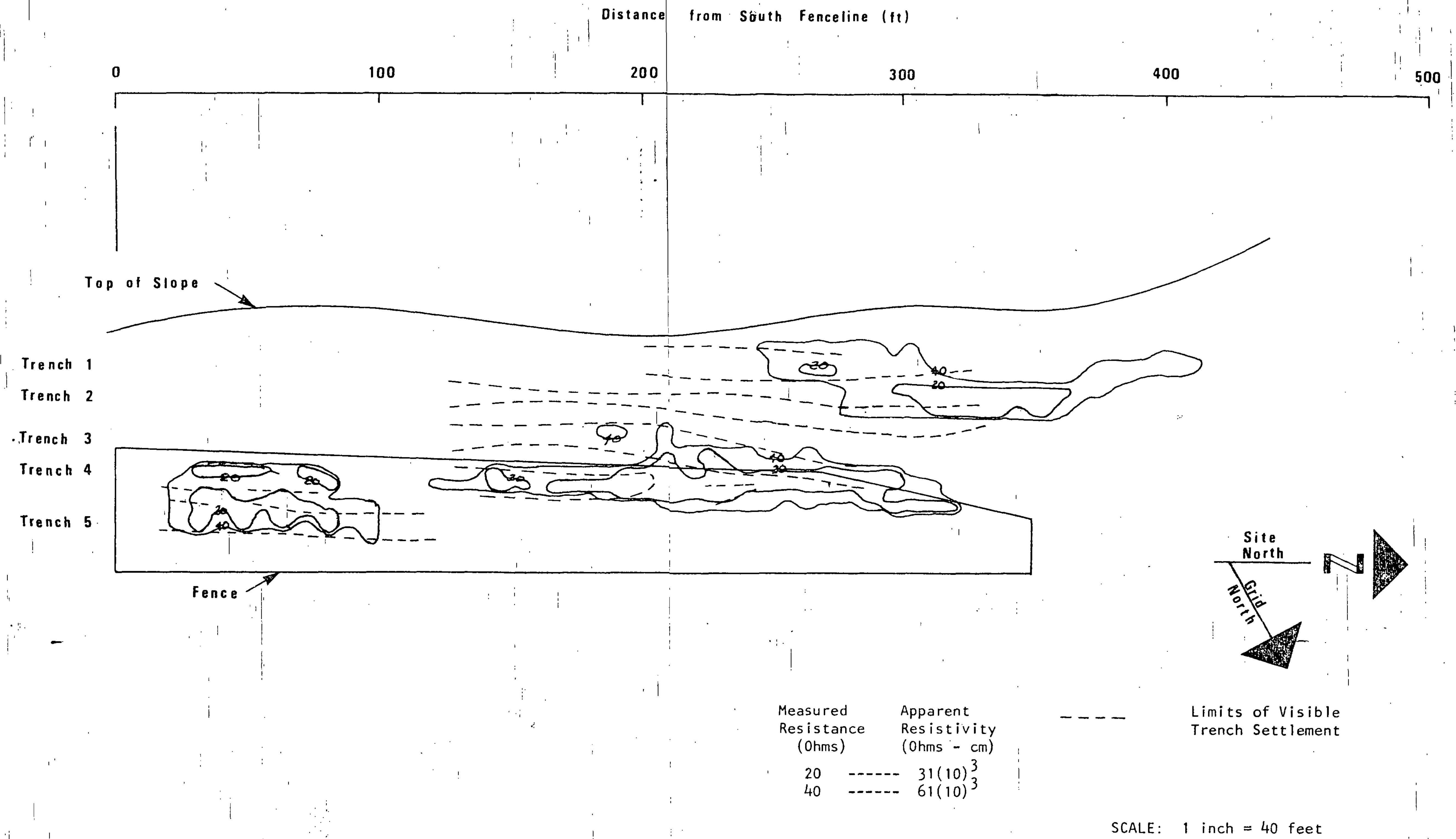


FIGURE 3

ZONES OF LOW APPARENT RESISTIVITY

Terracon Consultants, Inc.
Cedar Falls Cedar Rapids Davenport
Des Moines, IA
Kansas City Wichita, KS

1"=40'	GF	5-26-82	281613

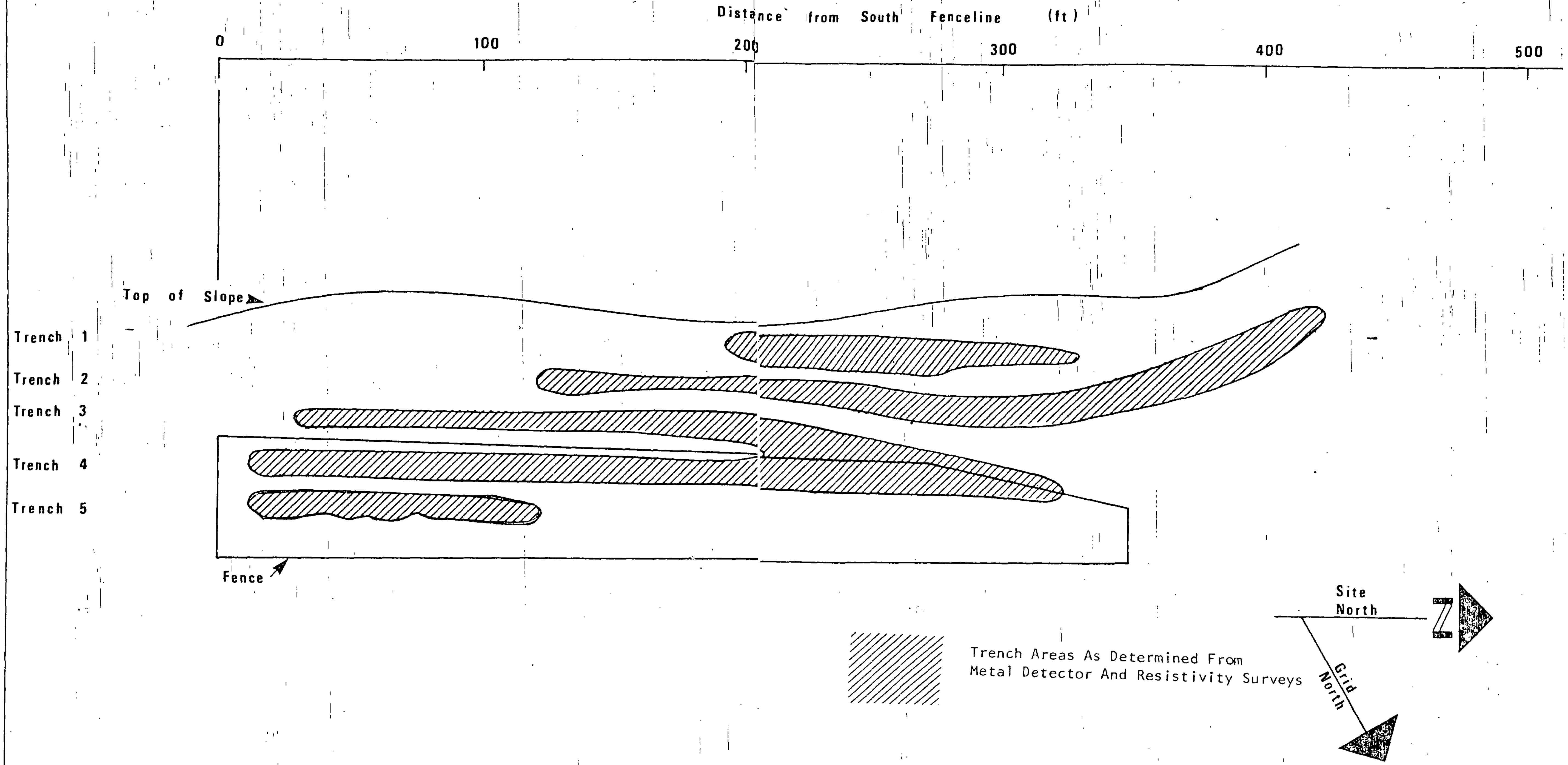


FIGURE 4. SCALE 1''=40'

APPROXIMATE TRENCH LOCATIONS AS INTERPOLATED FROM METAL DETECTOR AND RESISTIVITY SURVEYS

Terracon Consultants, Inc.
Cedar Falls Cedar Rapids Davenport Des Moines, IA
Kansas City Wichita, KS
Oklahoma City · Tulsa, OK

1''=40'	KDD	6-4-82	281613